

AIR WAR COLLEGE

AIR UNIVERSITY

US MILITARY, COMMERCIAL, AND INTERNATIONAL
COOPERATION
FOR
IMPROVED SPACE SITUATIONAL AWARENESS

By

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Contents

Disclaimer.....	ii
Illustrations.....	iv
Biography.....	v
Introduction.....	1
SSA in a Contested Domain.....	2
Current US Capabilities for SSA.....	5
SSA Cooperation.....	7
Advantages.....	9
Challenges.....	12
Recommendations for a Shared SSA Framework.....	14
Leadership.....	14
Membership.....	15
Protocols.....	18
Functions.....	19
Conclusion.....	20
Bibliography.....	23
End Notes.....	28

Illustrations

Figure 1: Notional Prediction of Satellite Collision.....	3
Figure 2: Congested Space around Earth Today and Future Prediction.....	4
Figure 3: The US Space Surveillance Network.....	6
Figure 4: LEO, MEO, HEO, and GEO Orbits.....	10
Figure 5: ADEOS with Solar Panel Extended and TIRA Image of Solar Panel Detached.....	11
Figure 6: US Near Earth Search and Track Coverage Focused in Northern Hemisphere.....	12
Figure 7: Proposed US Military, Commercial, and International Shared SSA Framework.....	20

Biography

Lt Col Ackerman entered active duty in 1991 after receiving a commission through the Air Force Reserve Officer Training Corps at Rutgers University. His first operational assignment was to the 3rd Space Operations Squadron, Schriever AFB, CO where he served as a Satellite Operations Crew Commander and Satellite Engineering Officer on the Defense Satellite Communication System. In 1994, Lt Col Ackerman moved to Osan Air Base, Republic of Korea where he was assigned to the 607th Combat Operations Squadron as a Reconnaissance Mission Director. He then became the 7th Air Force Chief of Theater Missile Defense and Space Operations and later the Operations Officer for Detachment 1, 3rd Space Surveillance Squadron. Upon completing his tour in Korea, Lt Col Ackerman returned to the United States and Vandenberg AFB, CA where he was assigned to the 614th Space Operations Squadron working special technical operations. In 1999 he was selected to attend the USAF Weapons School at Nellis AFB, NV and upon graduation, returned to Vandenberg AFB and was assigned to the 14th Air Force staff as the Chief of Weapons and Tactics, Special Programs. In 2001, Lt Col Ackerman was assigned to Camp H.M. Smith, HI and served on the staff of the Operations Directorate, Headquarters United States Pacific Command, where he was in charge of large-scale joint and combined military training exercises within the North East Asia region of the Pacific. In 2004, he was selected to attend the Air Force Institute of Technology at Wright Patterson AFB, OH where he received a Master of Science degree in Management with a focus area in Systems Engineering. In 2005, Lt Col Ackerman moved to Cheyenne Mountain AFS, CO where he was assigned as the Operations Officer for the 1st Space Control Squadron. In

2007, Lt Col Ackerman assumed command of the 17th Test Squadron, Schriever AFB, CO. He is now a PME student assigned to the Air War College at Maxwell AFB, Alabama.

Introduction

Since the launch of Sputnik in 1957, space has been transformed from a mostly serene environment to one bustling with activity. The past five decades have witnessed a global growth in reliance on space capabilities and a corresponding increase in the number of man-made objects in orbit. The capabilities and missions performed from space have proliferated in both sophistication and complexity. In addition, threats to on-orbit assets are also on the rise.

These factors all point to the need for an improved means to monitor, assess, and predict space activities to support better decision making. Today, the ability to assess the purpose of an observed space event and predict future actions is mostly absent. Instead, capabilities are limited to monitoring space activity in particular regions of space and focused mostly on cataloging space objects. While a database of positional information on space objects is important to a basic understanding of the space domain, the ability (for example) to predict a space event, and assess its purpose as either hostile or benign is also necessary. This type of understanding requires situational awareness (SA). SA is the knowledge of activities within a domain, which may affect the mission. Thus, the concept of space situational awareness (SSA) emerges as a necessity for the space domain.

The United States government (USG), along with commercial and international entities, has come to realize the great advantages space capabilities offer. Communications satellites (COMSAT) make reliable global communications possible and navigation satellites derive benefit for commercial and military purposes. Improving SSA is important given the growing increase of international space assets, the security reliance on space capabilities, the sheer

number of objects in orbit, and emerging and existent capabilities that can affect satellites. These aspects have led to the characterization of space as a contested domain.¹

This paper will demonstrate the need for a more robust SSA capability as a first step in contending with this contested environment. It will analyze current means for SSA and argue for improved capabilities through USG cooperation with commercial and international entities, and evaluate the advantages and challenges of such an approach. Finally, considering both potential advantages and challenges, it will submit near-term recommendations for a shared USG, commercial, and international SSA framework, led by the US military.

SSA in a Contested Domain

Within the traditional domains of land, sea, and air, commanders develop detailed orders of battle and continuously examine their domains for clear SA of activities that may affect their missions. This principle is as true for space as it is for the traditional domains.

Today, the US military tracks about 21,000 objects in orbit.² Fewer than ten percent are active satellites.³ The rest are dead satellites and space debris ranging from objects as small as 10 centimeters⁴ to large rocket bodies.⁵ In addition, estimates place the number of untrackable space objects smaller than 10 centimeters at several hundred thousand.⁶ Smaller objects typically consist of debris such as bolts, foil scraps, and other small pieces left over from a space launch,⁷ or unanticipated breakup of orbiting rocket stages when residual propellants explode.⁸

The large number of orbiting objects makes avoiding collisions in space a key aspect of SSA. Space is big, but collisions have occurred and the high speeds – over 17,000 miles per hour – of even small objects can cause devastating damage. A small fleck of paint collided with the Space Shuttle causing a deep and hazardous window chip, demonstrating the danger from

even very small pieces of debris.⁹ Underscoring the notion of space collisions was the February 2009 collision of a US commercial Iridium COMSAT and a dead Russian satellite, Cosmos 2251, over northern Siberia.¹⁰ The resulting collision created over 1,300 pieces of trackable debris, and probably even more undetectable pieces, all of which increase the danger of future space collisions.¹¹ At some point, space collisions could create a cascade of ever-increasing debris, which may remain on orbit for many decades, effectively limiting the domain for all future use.¹²

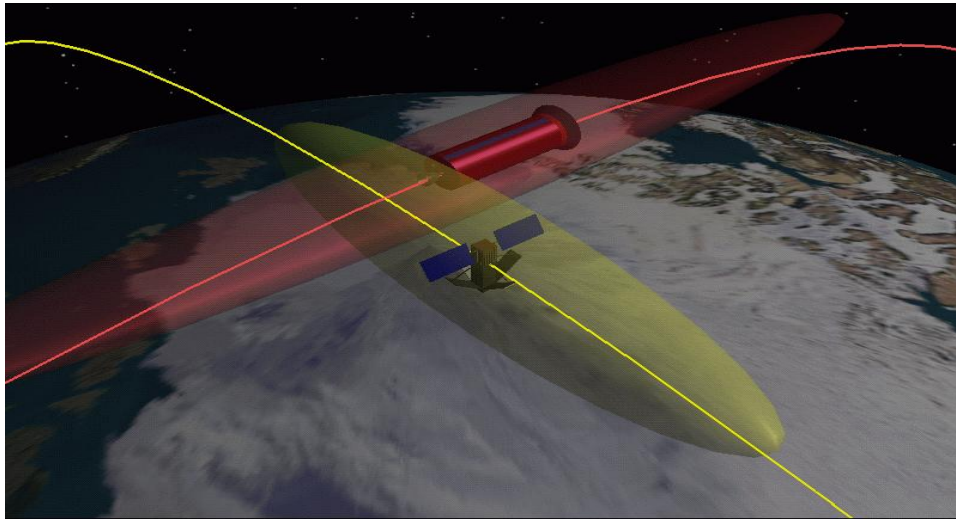


Figure 1: Notional Prediction of Satellite Collision

Satellite operators can take action to avert predicted collisions if at least one of the objects is maneuverable. For example, in 2004, the international space station and two classified Department of Defense (DoD) payloads all maneuvered to avoid a potential collision with other space objects.¹³ Similarly, in a little over a year period, the GeoEye-1 commercial imaging satellite maneuvered four times to avert orbital debris.¹⁴ The European Space Agency (ESA) also reported performing “avoidance maneuvers” to protect their satellites from collision.¹⁵ SSA is thus crucial to the USG, as well as commercial and international entities for preventing

collisions and extending the life of on-orbit assets. Having accurate SSA data averts false alarms, and when evasive maneuvers are necessary, only minimal fuel will be expended to avoid collision.¹⁶

The increasing number of satellites in orbit and the complex missions they perform complicates the ability to conduct effective SSA. In the early 1980s, only 10 countries operated satellites.¹⁷ Today, there are nine countries operating space launch facilities and over 50 countries own or share satellite ownership.¹⁸

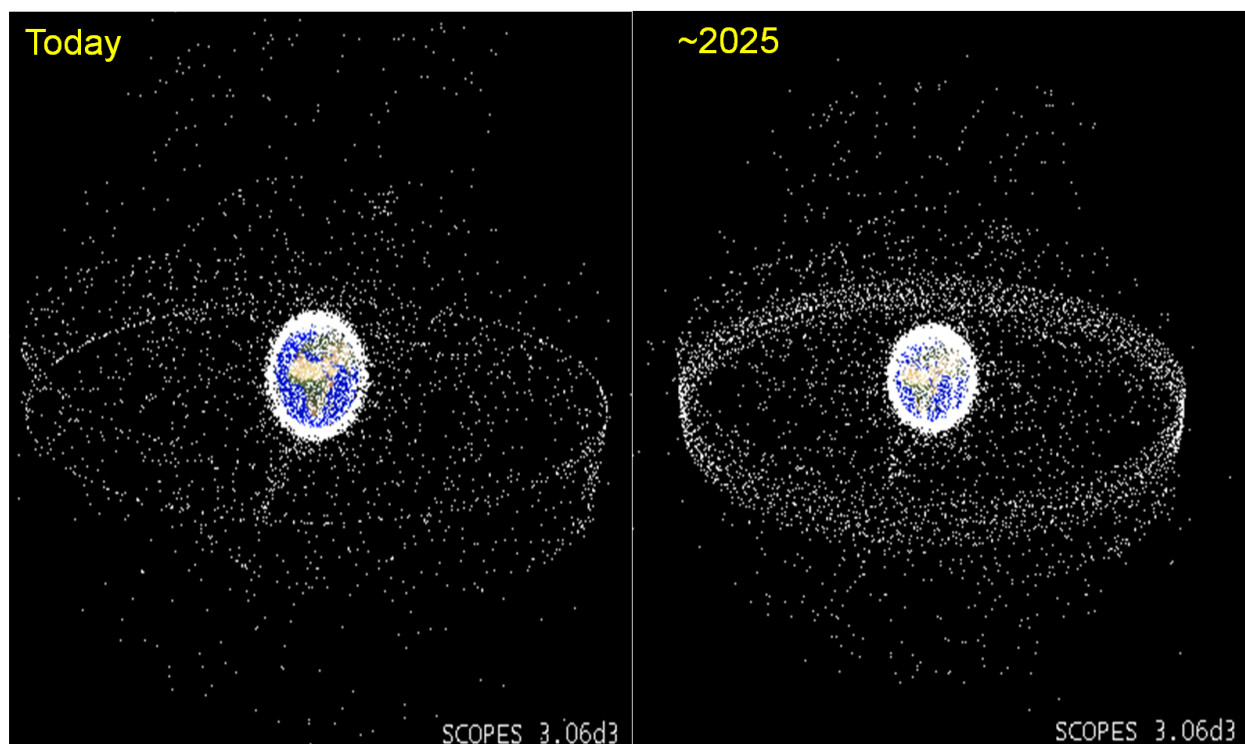


Figure 2: Congested Space around Earth Today and Future Prediction

Additionally, mission dictates drive orbit selection into one of several types causing congestion within these desirable orbits: low earth orbit, home to missions such as weather and reconnaissance, medium earth orbit for navigation, and the geosynchronous orbit, most often

used for communications.¹⁹ This congestion creates competition for orbital “real estate,” particularly in the geosynchronous orbit when positioning COMSATS to provide communication coverage of a specific region of the earth.

Space missions have also increased in complexity. For example, the 2008 Chinese Shenzhou-7 manned mission released a microsatellite, which detached itself from the host spacecraft and then performed a series of maneuvers, including a ‘proximity survey maneuver’²⁰ and closed to within 25 kilometers of the International Space Station.²¹ Although there was no direct offensive capability noted, proximity maneuvering could be a precursor to an offensive capability. One can envision the possibility of an orbital anti-satellite weapon or other weaponized potential requiring precision space maneuver.

Historically, space has been viewed by many as a sanctuary; an uncontested domain free from strife. However, as space becomes more congested with countries competing for advantage, the idea of space as a sanctuary fades from view and highlights the need for robust SSA.²²

Current US Capabilities for SSA

The core of today’s US SSA capability comes from a worldwide array of sensors called the Space Surveillance Network (SSN).²³ This network of radar and optical sensors has its roots in the Cold War with sensors optimized by design and location to address the intercontinental ballistic missile threat.²⁴ These sensors could also adequately “address the space threats and challenges of that day.”²⁵ However, space requirements have outgrown these Cold War capabilities.

The SSN employs a “tasked based” strategy.²⁶ Instead of a broad search of space, the tasked based strategy means the network of space sensors must be “told” where to look with significant precision. The basis of this tasking plan is an existent understanding of where a space object is expected to be. If the SSN successfully tracks the object as predicted, it then moves on to the next object in the tasking scheme. If an object is not detected as expected, a prioritized “search plan” is developed to find the object.



Figure 3: The US Space Surveillance Network

This design works well with a relatively small number of large objects, and when adding only a small number of new objects over time.²⁷ However, today there are more small satellites and space traffic has quadrupled over the past three decades.²⁸ Further, the Cold War surveillance strategy assumes non-threatening purposes by those operating in space, but recent activities such as China’s anti-satellite test in January 2007 now make it clear peaceful purposes in space may not be the rule. In May 2009 testimony to the Senate Subcommittee on Strategic Forces, Lt Gen Larry James, Commander of the Joint Functional Component Command for

Space called for improved SSA, stating, “We need to understand the location, status and purpose of these (space) objects, their capabilities and their owners’ intent. This comprehensive knowledge enables decision makers to rapidly and effectively select courses of action to ensure safety in what is clearly a contested space environment.”²⁹ To support these decision makers effectively requires robust SSA at the tactical, operational, and strategic levels. Consider the following scenario: At the tactical-level, a satellite operator needs SSA to determine if the cause of an on-orbit satellite failure was from a system malfunction, naturally occurring phenomenon, or a hostile act. SSA informs the operational-level decision maker’s course of action for mitigating the mission impact from the satellite failure. At the strategic level, national-level decision makers need SSA to help attribute what was determined to be a satellite attack, and formulate a national-level response. Today’s SSN is simply inadequate for conducting this type of robust SSA.

The SSN only provides a piece of the SSA picture. It can generally address *what is in space*, but is lacking in the ability to tell *what is going on in space*. SSA must provide a better perspective, with a capability that can monitor, assess, and predict to facilitate improved decision making. SSA transformation, which includes cooperation with commercial and international partners, is needed to meet current and future space domain challenges.

SSA Cooperation

Space capabilities are essential to national security, and fundamental to everyday life.³⁰ For example, the Global Positioning System (GPS) not only enables precision weapons, but also provides a precise timing signal integral for synchronization of power grids, communication systems, and international banking transactions.³¹ The United States and other nations are reliant

on the benefits these capabilities provide, and thus it is in the best interests of not only the USG, but international and commercial entities as well, to enhance SSA to help protect these vital and valuable resources.

The current system to provide unclassified SSA data to commercial and international organizations (as well as to the public) is insufficient. Presently, a web-based system called space-track.org, interfaces with an unclassified repository of satellite positional data called the satellite catalog, maintained by US Strategic Command's (USSTRATCOM) Joint Space Operations Center (JSpOC). Anyone with a user account can retrieve data on any object listed on the website.³² Not only does this design raise security concerns,³³ but also it is a one-way channel with the USG providing data and reaping no reciprocal benefit.

Cooperative data-sharing between the USG, commercial, and international partners can greatly improve SSA. Through cooperative efforts, the USG benefits by gaining insight into status of commercial and international satellites, space launch profiles, system capabilities, planned maneuvers, and points of contact for resolving conflicts between on-orbit assets.³⁴ Similarly, commercial and international partners benefit from US support for launch and on-orbit collision avoidance, tracking, anomaly resolution, de-orbits, and end-of-life operations.³⁵ However, any effort at USG cooperation with commercial and international entities faces challenges including protecting US national security interests. Therefore, it is necessary to evaluate specific advantages and challenges regarding SSA cooperation.

Advantages

Commercial and international partnerships can dramatically improve SSA by providing precise information on mission specific activities from launch, to on-orbit operations, to final satellite disposal activities. Key benefits to commercial and international cooperation include quantitative and qualitative improvements in SSA data, freeing SSN sensors for other tasking, and improved collision forecasting. A significant input from commercial and international operators, which can enhance an essential characteristic of SSA, is space object positional information.

An element set (ELSET) provides positional data on a satellite. An ELSET contains all the information needed to fix an object's position in space at a given time. Satellite operators; whether they are US military, civil, commercial, or foreign will typically possess the most accurate ELSETs on their satellites. This is because satellite operators have access to positional data coming directly from their satellite and ground stations that provides an approximate 25 percent increase in accuracy over the SSN.³⁶ Therefore, satellite operator derived ELSETs improve SSA tasks such as accurately predicting collisions between space objects.

As the SSN relies on being “told” where to look to track space objects, it can only estimate which sensors will detect a new space object based on the object's initial launch azimuth. While satellites going into low earth orbit (LEO) will eventually fly through the “detection fan” of a sensor, objects going beyond LEO, to medium earth orbit, (MEO), geosynchronous orbit (GEO), or highly elliptical orbit (HEO), can quickly become “lost” as they move beyond the SSN's ability to track. Without knowing the plan for maneuvering from LEO to one of these other orbits, a great deal of time and effort may be required to search and re-identify the satellite as it moves to a final orbit. Of course, tracking a satellite is easier when a satellite operator *provides* their ELSETs. In addition to collision avoidance, this type of precise

SSA aids other important tasks such as radio frequency deconfliction and anomaly detection/resolution on known space objects where operators' ELSETs are available. On the other hand, for detecting, tracking, and identifying unknown space objects, additional sources of SSA information are required.

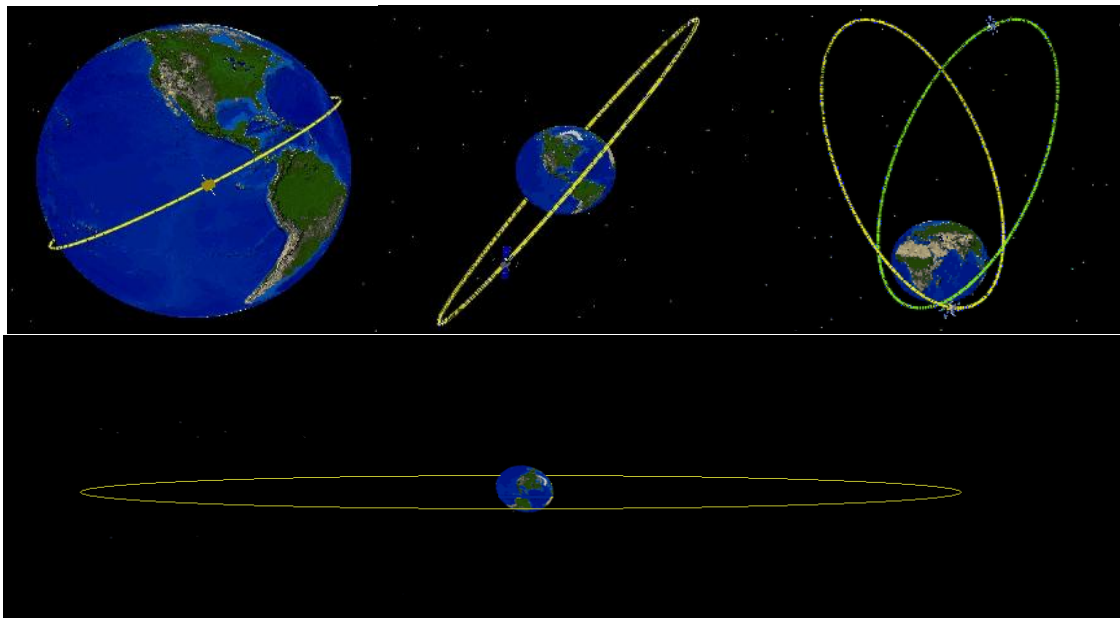


Figure 4: LEO, MEO, HEO, and GEO Orbits (from left to right, top to bottom)

Expanding information sources via cooperation will improve SSA. One potential source is the ESA, which has approved a plan for a European SSA capability.³⁷ Their initial capability will integrate existing radars and optical sensors from ESA-participating governments into a single network.³⁸

The ESA network would bring useful capabilities to the SSN such as Germany's Tracking and Imaging Radar (TIRA), which can detect space objects as small as 2 centimeters.³⁹ In addition to the ability to track smaller objects, TIRA can also image space objects which aids in SSA tasks such as identifying unknown objects and anomaly resolution. When the Advanced

Earth Observation Satellite (ADEOS) failed due to loss of electrical power, the TIRA radar was able to help trace the cause to a solar panel fault.⁴⁰ While SSA will benefit from cooperative sharing of data sources from places such as ESA, another potential improvement is increased SSA coverage.

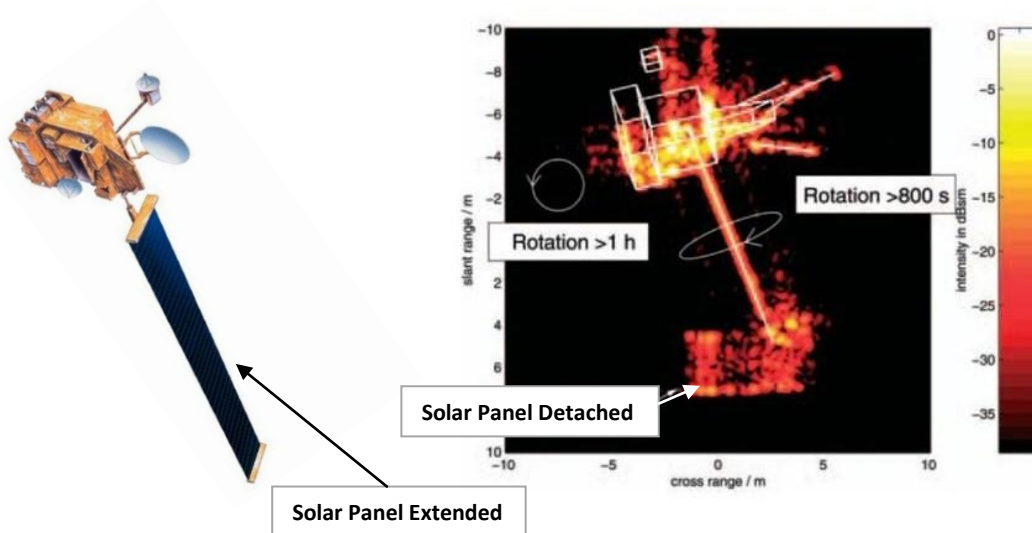


Figure 5: ADEOS with Solar Panel Extended and TIRA Image of Solar Panel Detached

Today's SSN provides generally acceptable tracking in the northern hemisphere but has a substantial coverage gap in the southern hemisphere.⁴¹ Being blind to half of the domain is hardly akin to robust situational awareness. Currently, ESA and other potential SSA partners do not have sensors in the southern hemisphere that could significantly contribute to SSA.⁴² Therefore, establishing new sensors in the southern hemisphere through commercial and international engagement can open up the other half of the picture to SSA. For example, a space-observing radar in Australia would provide southern hemisphere tracking of orbiting space objects and could also initially track southerly launches from China.

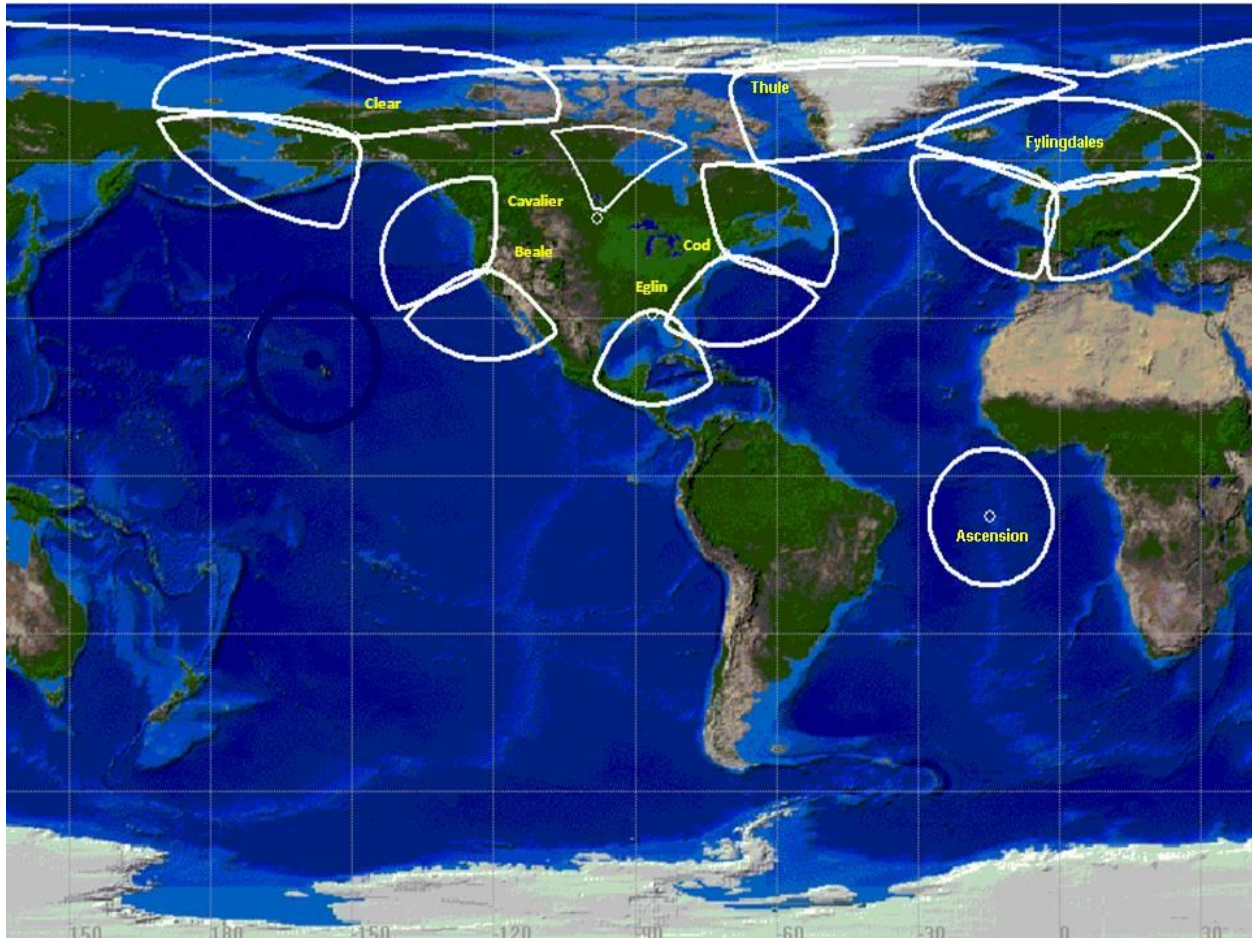


Figure 6: US Near Earth Search and Track Coverage Focused in Northern Hemisphere

Challenges

With any endeavor that involves the interests of so many entities, there are bound to be challenges. Separating space's national security aspects from the benefits derived through cooperation is one major challenge; other issues include interoperability and legal ramifications.

From the military perspective, the primary challenge to a shared SSA capability is the issue of security. Determining who can receive SSA data, what data to release, how to release it, and when to release it are key questions that must be answered. If the US military has information on satellites that requires protection, then vigilance and perhaps discretion in

publishing or passing this information must be exercised. In a November 2008 memo, Lt Gen William Shelton, then the commander of Fourteenth Air Force stated, “As space becomes an increasingly contested environment, we must be cautious about disseminating Space Situational Awareness data to unknown recipients.”⁴³ Without proper consideration as to what data is being released and to whom, could in General Shelton’s words, “potentially provide cueing and/or targeting data to our adversaries.”⁴⁴

The systems put in place must employ technical and procedural controls to restrict information as appropriate in order to protect US space assets or employ capabilities in battle against adversaries. However, political concerns could well affect wartime SSA data. For example, SSA could become analogous to GPS, a global utility so highly integrated into everyday life that the thought of limiting its access introduces global economic and worldwide safety concerns. Should SSA end up providing the ubiquitous and unexpected benefits that GPS has, similar ramifications in restricting access may well be felt. Additionally, the US military must be cautious and not develop complete dependencies on external sources for conducting military missions since member provided information may not always be available.

SSA interoperability and workable interfaces will be difficult to achieve. Many capabilities that could contribute to a common SSA database were built as “stove-piped” or closed systems. Getting these capabilities to now “talk” to each other will require interfaces to bridge the gap between disparate standards and data formats. Additionally, safeguards would be required for any data coming into the SSN from outside sources. As mentioned previously, many of the sensors that currently make up the SSN also concurrently provide missile warning for North America where corrupted data must not be allowed to enter.

The legal issue associated with operating a shared SSA framework also presents a challenge. The only organization within the USG capable today of operating such a capability is the Joint Functional Component Command for Space (JFCC Space) through the JSpOC. However, JFCC Space is subordinate to USSTRATCOM, a combatant command. Combatant commanders cannot enter into new agreements that may be required to assemble a shared SSA framework with non-DoD entities without permission from the Secretary of Defense.⁴⁵ Therefore, interactions between the US military and participating commercial and international members must avoid United States Code (USC) Title 10 conflicts. Additionally, questions of liability may arise in the event a participating member takes action based on shared information that results in a harmful outcome. Without the proper legal framework, the USG could become responsible for claims due to actions taken (or not taken) by members relying on information received from USSTRATCOM.⁴⁶

Recommendations for a Shared SSA Framework

A shared framework for SSA will need to consider many factors. The most fundamental considerations will be the leadership, membership, protocols, and functions provided by the framework.

Leadership

The United States should take the lead role in creating a shared SSA capability by establishing a USG, commercial, and international SSA framework, led by the US military. Due to similarities between conducting SSA and conducting “air SA” via the air traffic control system, one might argue a US civil agency would be the right option for leading such a framework. However, the US military possesses the preponderance of the assets that would

comprise this framework and the ability to control it via the JSpOC. Therefore, for at least the near term, the US military is the logical choice to lead this endeavor, especially as national policy charges the Secretary of Defense with the responsibility for SSA.⁴⁷ This would provide the US military a controlling interest in management and administration of the capability while still providing the means for others to participate and benefit. The SSA framework and data, but not all physical assets (e.g., sensors), in essence would be managed by the US military, which can then allow others to join per membership criteria. It will be important for the USG to minimize the appearance that this framework promotes US hegemony in space by emphasizing aspects of cooperation that promote common interests in furthering space safety and economic benefits for all participants.

Furthermore, US leadership in building a shared framework would likely preempt others from establishing competing SSA networks. Competing networks would bring a fractured, overall weaker approach to SSA. Furthermore, competing networks would be beyond the purview of the USG's ability to oversee their operations and thus weaken the USG's ability to influence them in favor of US national security interests. Already, the lack of an existing shared approach has led three commercial satellite operators to explore the possibility of a non-DoD commercial SSA capability.⁴⁸ If the US military establishes this framework and takes the lead in sustaining and managing it, potential commercial and international members will see a less expensive yet credible method to obtain SSA benefits.

Membership

Criteria for membership in the framework should be based on prospective member's ability to contribute sensor data input and/or information concerning their on-orbit assets such as

satellite health and status, planned maneuvers, de-orbits, etc. Additionally, a track-record of space stewardship such as efforts at debris mitigation and adherence to international laws and norms for operating in space should also be considered. Although a pro-US orientation for members is desired, it need not be a defining membership criterion. However, countries openly hostile towards the United States should not be expected to benefit.

In the case of international partners, ESA could offer valuable input to improve SSA. Additionally, ESA's 18 members⁴⁹ are all partnered with NATO, indicating a cooperative orientation towards the United States.⁵⁰ As ESA is already considering its own SSA capability via a network of sensors from ESA countries, establishing an initial shared capability is possible by tying the ESA network together with the SSN. In such a relationship, NASA could provide an initial "pass-through" between the military and ESA, as NASA and ESA already have established agreements and mechanisms for sharing information and providing mutual support.⁵¹ This arrangement avoids any USC Title 10 conflicts regarding the military providing support to a foreign country. Next, non-ESA NATO countries and others in US military alliances could be given the opportunity to join if they possessed a contributing SSA capability, such as a sensor site or satellite. Leveraging existing mechanisms for military-to-military sharing of information within the alliance structures, once again mitigates challenges associated with US military support to foreign entities.

Table 1. ESA countries and NATO relationship

ESA Country	Relationship with NATO
Austria	Partner Country
Belgium	Member Country
Czech Republic	Member Country
Denmark	Member Country
Finland	Partner Country
France	Member Country
Germany	Member Country
Greece	Member Country
Ireland	Partner Country
Italy	Member Country
Luxembourg	Member Country
Netherlands	Member Country
Norway	Member Country
Portugal	Member Country
Spain	Member Country
Sweden	Partner Country
Switzerland	Partner Country
United Kingdom	Member Country

Commercial space capabilities are essential to national security. For example, about 80 percent of DoDs SATCOM comes via commercial satellites⁵² and the military also exploits commercial satellite imagery.⁵³ Thus, a partnership for improving SSA to help protect these assets is beneficial to both the USG and these commercial providers. Exploiting existing mechanisms for government exchange of information with commercial providers will facilitate information sharing while preventing liabilities on the part of the USG. As the benefits of association in such a cooperative framework become evident, more commercial and international entities will seek membership.

Protocols

Protocols provide a common operating basis for participation within the framework to enhance effective and efficient functioning. Specific framework protocols for consideration include the following:

- Institute rules governing the transfer of data to non-members of the framework.
Recommend employing agreements similar to those used in foreign military sales to mitigate unauthorized third party disclosure of framework-derived data.
- Develop procedures for operations in peacetime and conflict to protect national security interests. In peacetime, the basic premise should be on openness and sharing of data to the maximum extent possible. However, a voluntary and non-contractual framework allows members to withhold sensitive data for wartime necessity.
- Determine threshold SSA requirements to conduct US military operations. Ensure minimum information needed to conduct military missions is always available independent of input from framework members.
- Agree to standards for use within the framework such as data and message formats to facilitate machine-to-machine interfaces and data use.
- Formulate safeguards through a data “certification” process to ensure data external to the SSN meets mission needs (e.g. data accuracy) and information assurance requirements.
Data certification alleviates concerns involved with the intertwined missile warning vestiges within the SSN and ensures all SSA data fulfills user expectations.
- Establish an effective and efficient method for tasking framework sensors.

Functions

The SSA framework should provide a collaborative environment that presents SSA functions, derived from member input, back to the members of the framework. Since framework participation is voluntary, this elective participation allows members to provide functions at their discretion and within their means.⁵⁴ These discretionary functions should include those informational products and services that facilitate safe on-orbit activities and enhance member operations.

Functions related to space flight safety include tasks such as launch collision screening, orbital conjunction assessment, collision avoidance maneuvers, anomaly resolution, de-orbits, reentry and impact predictions, electromagnetic interference deconfliction, and clearance for laser firings. Functions enhancing member operations focus on providing a more predictive SSA capability. By receiving information such as launch parameters, planned maneuvers, disposal plans, and satellite status, the USG along with participating members are better postured for making SSA into a predictive (vice reactive) tool.

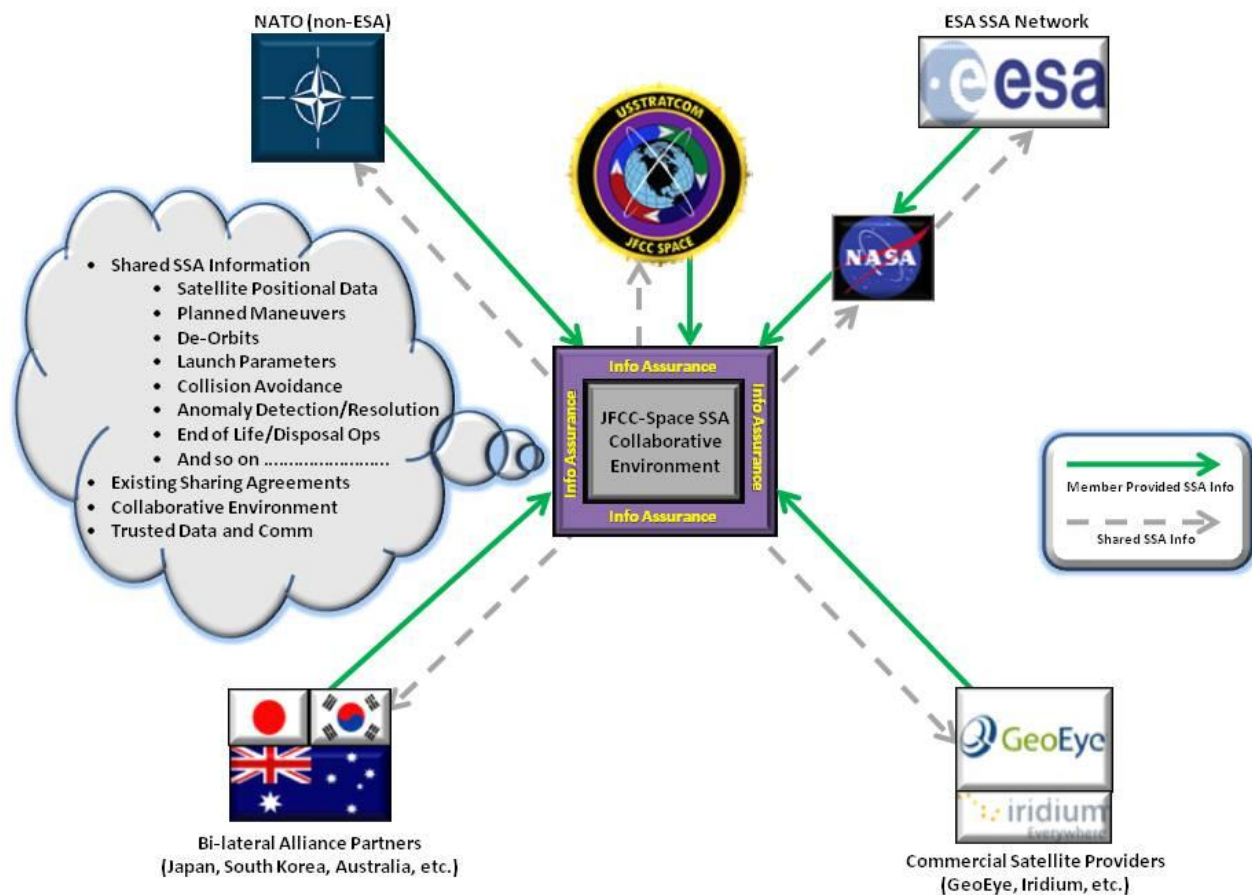


Figure 7: Proposed US Military, Commercial, and International Shared SSA Framework

Conclusion

US National Space Policy places the responsibility for SSA on the DoD.⁵⁵ While the US military is currently unable to conduct adequate SSA to meet today's challenges, it can improve its capability through cooperation with commercial and international partners. Although organizational, policy, and technical challenges exist, a shared framework that provides enhanced capability for the United States, while also benefiting commercial and international entities, is possible.

The initial framework recommendations presented here should precede a larger and more formal cooperative effort. This initial framework is limited in scope and participation, which is by design and is shaped by the practical realities of limited capabilities as well as unanticipated SSA ramifications.

These recommendations are not meant to promote US hegemonic control of space, but instead provide a starting point that allows flexibility for an evolved structure. In the future, a “Federal Space Administration” may form to lead a construct for the elements of SSA similar to today’s air traffic control system. Still, even if a federal agency were to emerge, the US military will still have a SSA requirement for military necessity just as military land, air, and sea commanders require SA specific to military purposes within their respective domains.

Taking the lead now postures the military properly for ensuring national security interests and allows the military to shape future constructs with national security in mind. For example, this fledgling framework leaves the door open to creation of a NATO-like alliance of likeminded countries for collective space security, alongside a more inclusive international system primarily focused on general spaceflight safety. As stated by Brig Gen Jay Santee, Principal Director for Strategic Capabilities at the Office of the Deputy Assistant Secretary of Defense, “expanded engagement is not only important to promote space flight safety through shared situational awareness, but also is a key element of our broader efforts to cooperate with likeminded countries to assure a realization of our mutual security goals against shared threats.”⁵⁶

With the preponderance of SSA assets and the ability to control them via the JSPOC, the US military is the logical choice to lead an initial shared SSA framework through cooperation with commercial and international partners. As stated in the National Defense Strategy, the

United States faces a “spectrum of challenges” to include challenges in space and to prevail must “work closely with a wide range of allies, friends and partners.”⁵⁷ Furthermore, a review of space policy is underway and changes are expected to stress improving space capabilities through international and commercial cooperation.⁵⁸ The day is coming when the United States will need to establish an approach for SSA cooperation with commercial and international partners to meet the challenges of a contested space domain and the time to start is now.

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